

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

Claims 1-13 (canceled).

14. (currently amended) A method of manufacturing a piezoelectric vibrator unit, comprising the steps of:

(a) preparing a green sheet in which through holes are opened in the vicinity of at least one end portion thereof which is to be a vibrating region of the piezoelectric vibrator;

(b) forming a conductive material layer of conductive material on the green sheet while filling the through holes, such that a first conductive region to be a segment electrode and a second conductive region to be a common electrode are formed, while defining a strip-shaped non-conductive region having no conductive material, therebetween-is formed in an area which is nearer to a center portion of the green sheet than the through holes, and is to be coincident with a distal end of an internal common electrode;

(c) repeating the steps (a) and (b) to stack required number of layers ~~until through holes to be electrically connected with a segment electrode are filled;~~

(d) baking the above to form a single piezoelectric material diaphragm; and

(e) forming slits on the piezoelectric material diaphragm so as to elongate to an area where at least the conductive layers ~~can be~~are separated from each other to constitute piezoelectric vibrators.

15. (currently amended) A method of manufacturing a piezoelectric vibrator unit, comprising the steps of:

(a) preparing a green sheet in which through holes are opened in the vicinity of at least one end portion thereof which is to be a non-vibrating region of the piezoelectric vibrator;

(b) forming a conductive material layer of conductive material on the green sheet while filling the through holes, such that a first conductive region to be a segment electrode and a second conductive region to be a common electrode are formed, while defining a non-conductive region, having no conductive material, therebetween,~~such that a strip-shaped non-conductive region is formed in an area which is nearer to a center portion of the green sheet than the through holes, and is to be coincident with a distal end of an internal common electrode;~~

~~(c) preparing a next green sheet in which through holes are opened in the vicinity of at least one end portion thereof which is to be the vibrating region of the piezoelectric vibrator;~~

~~(d) forming a conductive material layer on the green sheet while filling the through holes, such that a strip-shaped non-conductive region is to be coincident with a distal end of an internal individual electrode;~~

~~(e)(c) repeating the steps (a) to (d) and (b) to stack a required number of layers until through holes to be electrically connect with a segment electrode is filled;~~

~~(f)~~(d) baking the above to form a single piezoelectric material diaphragm; and
~~(g)~~(e) forming slits on the piezoelectric material diaphragm so as to elongate to an area where at least the conductive layers ~~can be~~are separated from each other to constitute piezoelectric vibrators.

16. (Original) The piezoelectric vibrator unit as set forth in claim 14, wherein the through holes are opened so as to coincide with an arrangement pitch of the piezoelectric vibrators.

17. (Original) The piezoelectric vibrator unit as set forth in claim 15, wherein the through holes are opened so as to coincide with an arrangement pitch of the piezoelectric vibrators.

18. (Original) The piezoelectric vibrator unit as set forth in claim 14, wherein the slits are formed so as to coincide with an arrangement pitch of through holes formed in one end portion which is to be a free end of the piezoelectric vibrator.

19. (Original) The piezoelectric vibrator unit as set forth in claim 15, wherein the slits are formed so as to coincide with an arrangement pitch of through holes formed in one end portion which is to be a free end of the piezoelectric vibrator.

Claim 20 (canceled).

21. (previously presented) The method of manufacturing according to claim 14, wherein the through holes in adjacent layers are formed to be slightly offset from each other in an axial direction, such that the through holes of alternate layers are positioned in one line.

22. (previously presented) The method of manufacturing according to claim 15, wherein the through holes in adjacent layers are formed to be slightly offset from each other in an axial direction, such that the through holes of alternate layers are positioned in one line.

23. (previously presented) The method of manufacturing according to claim 14, wherein a width of the through holes is formed to be larger than a thickness of the respective green sheet.

24. (previously presented) The method of manufacturing according to claim 15, wherein a width of the through holes is formed to be larger than a thickness of the respective green sheet.

25. (withdrawn) A method of manufacturing a piezoelectric vibrator unit including a plurality of piezoelectric vibrators, comprising:

(a) preparing a green sheet in which through holes are arranged in a first direction
~~and in a vicinity of at least one of both ends of the green sheet in a second direction~~
perpendicular to the first direction;

(b) forming a conductive material layer on the green sheet such that a first conductive region and a second conductive region are formed while defining a non-conductive region therebetween so as to avoid the through holes, and such that the through holes are filled with a conductive material;

(c) repeating the step (a) and the step (b) to form a lamination body in which a required number of green sheets and conductive material layers are laminated;

(d) baking the lamination body to form a single piezoelectric material diaphragm; and

(e) forming slits on the piezoelectric material diaphragm so as to avoid the through holes, and to traverse at least the first conductive region in each conductive material layer in the second direction, so that the first conductive region is divided into a plurality of divided conductive regions by the slits,

wherein each of the divided conductive regions is to be a segment internal electrode of the piezoelectric vibrator unit, and the second conductive region in each conductive material layer is to be a common electrode of the piezoelectric vibrator unit.

26. (withdrawn) The manufacturing method as set forth in claim 25, wherein the through holes are arranged at a fixed pitch identical with an arrangement pitch of the piezoelectric vibrators.

27. (withdrawn) The manufacturing method as set forth in claim 25, further comprising fixing an end portion of the piezoelectric material diaphragm, in which the second conductive region is formed, on a fixing substrate before the slits are formed.

28. (withdrawn) The method of manufacturing according to claim 25, wherein the through holes in adjacent layers are formed to be slightly offset from each other in an axial direction, such that the through holes of alternate layers are positioned in one line.

29. (withdrawn) The method of manufacturing according to claim 25, wherein a width of the through holes is formed to be larger than a thickness of the respective green sheet.

30. (new) The method of manufacturing a piezoelectric vibrator unit according to claim 14, wherein the slits on the piezoelectric material diaphragm are formed so as to avoid the through holes.

31. (new) The method of manufacturing a piezoelectric vibrator unit according to claim 14, wherein the non-conductive region is formed in an area which is nearer to a center portion of the green sheet than the through holes.

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32. (new): The method of manufacturing a piezoelectric vibrator unit according to claim 15, wherein the slits on the piezoelectric material diaphragm are formed so as to avoid the through holes.

33. (new) The method of manufacturing a piezoelectric vibrator unit according to claim 15, wherein the non-conductive region is formed in an area which is nearer to a center portion of the green sheet than the through holes.